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NEW LIGHT ON THE FLIGHTLESS GOOSE *CHENDYTES LAWI*

By Loye Miller[1], Edw. D. Mitchell[2] and Jere H. Lipps[3]

Excavations recently carried on in a marine terrace deposit on Anacapa Island, Ventura County, California, have yielded well preserved avian fossils which constitute a new fossil bird locality and have greatly increased our knowledge of the extinct anserine, *Chendytes lawi.*

Mr. Jim Gladson first worked in the locality and retrieved a single bird bone which was later identified by Dr. Hildegarde Howard as *Chendytes.* The junior authors made two trips to the island during 1960 and collected extensively. An area of approximately fifteen square yards was leveled off. Several bird bones were collected, and many sandstone blocks were brought back to the University of California at Los Angeles. Here the senior author spent much of the late summer of 1960 in working the bones from these blocks and in studying their significance.

All but ten of the bird bones represent *Chendytes lawi* Miller. A small number of rodent bones from the deposit were studied by Dr. J. A. White of Long Beach State College, who considers them to represent an undescribed form of *Peromyscus.* No invertebrate remains occur in the deposit.

The site, recorded as Los Angeles County Museum Vertebrate Locality no. 1642, is located on the north shore at the eastern end of West Anacapa Island ("Big Anacapa") and lies twenty-five feet above sea level at latitude 34° 00′ 25″ N. and longitude 119° 24′ 35″ W. The deposit is composed of 5½ ft. of dark gray, loosely consolidated sandstone derived from the Conejo Volcanics (Scholl, 1960). The sandstone rests upon Conejo Volcanics and intergrades into eight feet of overlying talus. Fossil bones occur throughout the exposed sandstone, but the articulated specimens came from the intergrading zone. We consider the deposit to represent a remnant of the supra-littoral zone of a Pleistocene shore line. It may be equivalent to the Garanon member of the Santa Rosa Island Formation. The Fox member of the Santa Rosa, which overlies the Garanon member, has been dated as being not less than 33,000 years old (Orr, 1960).

Preservation. Skeletal elements of *Chendytes lawi* that have been coming to hand during the past thirty-five years have all been from mainland shell beds. All have been fairly well mineralized and many of them very little abraded by "beach wear." None have heretofore been found in their normal anatomical relation to each other. The Anacapa

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specimens, on the contrary, are little mineralized. (Impregnation with plastic is a prerequisite to safe handling.) They are, however, sometimes in anatomical relations. Fragmentation and crushing are evident in some cases, an effect we ascribe to micro-local land slips or talus action from above.

The species was long known from the posterior limb bones only. However, the extensive collecting by Los Angeles County Museum parties from numerous and widely separated localities ultimately convinced Howard (1947) that certain degenerate wing and shoulder elements which occurred in the same deposits with typical *Chendytes* femora and tarsi, could belong to no other bird. She hypothecated an insular species that had become completely flightless. Subsequent discoveries on San Nicolas Island substantiated this hypothesis by providing not only added evidence, but a presumably ancestral species, *C. milleri* Howard (1955) from lower Pleistocene deposits, that showed an earlier stage of the degenerative trend in the pectoral complex. The San Nicolas bird was smaller than *Chendytes lawi*, but it had a larger, though already weakened humerus. The collections from both San Nicolas and Anacapa islands, being almost mono-specific, remove all doubt that might linger in the minds of ornithologists regarding the degeneracy of the wing in *Chendytes*. On Anacapa Island the late Pleistocene species *C. lawi* is well represented by typical femora, portions of pelves, and fragments of tibiotarsus, together with coracoid, scapula and humerus, and fragments of the sternum, all of which show the advanced state of degeneracy into complete flightlessness. A partial skull, vertebrae, ribs, and pedal phalanges complete the assemblage.

PELVIS. The pelvic limb bones have received sufficient attention during the previous 35 years through the writings of Miller and of Howard. Howard (1949, p. 25) has discussed an anterior fragment of pelvis, pointing out certain resemblances to the mergansers and geese as contrasted with the surf ducks. Such convergence toward the geese is to be expected since the geese are better walkers than the surf ducks. The flightless *Chendytes* had, of necessity, to walk to and from its nest site. A practically complete pelvis was collected from Anacapa (Plate 2, L.A. Co. Mus. no. 2696). The strengthening noted in the anterior region is further demonstrated by the post-acetabular part of the innominate as preserved in the Anacapa material. Both the ilium and the ischium become convex and thickened with addition of some cancellated bone between layers. The posterior border of the innominate in most birds is extremely thin; this profile in the specimen of *Chendytes* at hand has been imperfectly preserved. Enough, however, remains to give the general impression of a strong anseriform pelvis, approximately equal in length to that of an adult *Branta canadensis canadensis*.

So far as preserved, the ischium extends 92 mm. backward from the center of the acetabulum, and the ilium extends 52 mm. forward from the

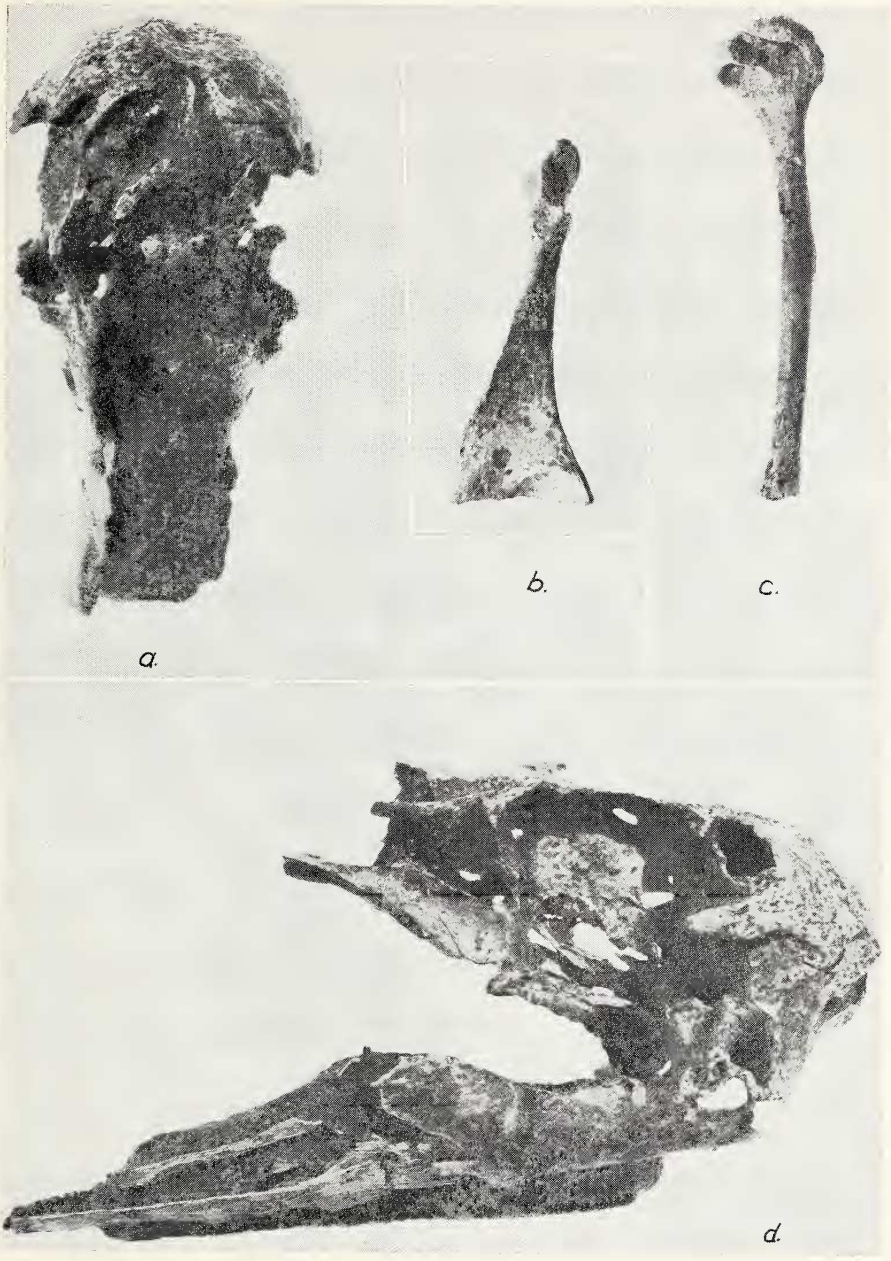

PLATE 1

Chendytes lawi Miller. a. Posterior view of cranium, L.A.C.M. no. 2699 (lower jaw in matrix attached); b. posterior view of coracoid, L.A.C.M. no. 2697; c. ulnar view of humerus, L.A.C.M. no. 2698; d. left side of cranium and attached lower mandible, L.A.C.M. no. 2699.

same point. The synsacrum measures 131 mm. in length and 17 mm. across at its widest point. Fragments of at least two other pelves were retrieved.

VERTEBRAE. In addition to the atlas, axis and cervical vertebra number 3 that were attached to the occiput of the skull (L.A. Co. Mus. no. 2699), a series of eight vertebrae (L.A. Co. Mus. no. 2702) were found either articulated or very closely associated in the matrix. They articulate well and seem to represent one individual. The general configuration of the vertebrae, and particularly the shape of the ventral spine, closely resembles nos. 11-18 in both *Melanitta perspicillata* and *Melanitta deglandi*. In both of these living species no. 16 bears the first (incomplete) rib, and the contours of the fossil vertebra suggest that the same applies here. Number 17 bears the first complete rib (that reaches the sternum) in the scoters; presumably the same is true of *Chendytes*. In *Anser albifrons* and *Chen hyperborea*, vertebra number 19 bears the first complete rib. In the absence of a complete series of vertebrae for *Chendytes* we must admit that the numbers assigned to the fossil vertebrae are not beyond question. Several less perfect vertebrae appear to have come from a smaller carcass.

The fossil vertebrae differ from those of the surf ducks in their far greater size, being equal in that respect to those of large male *Branta canadensis*. All vertebrae give the impression of ruggedness by extension and strengthening of the transverse processes. Vertebrae 15, 16 and 18 possess transverse processes in excess of those of *Branta* (the processes are broken in no. 17 in the fossil). Thus the impression is produced that *Chendytes* had a thick and powerful neck. What feeding habit was correlated with this character is a matter of pure conjecture, but it must have been an activity that involved a considerable muscular effort. The diet of the Surf Scoter while on its wintering grounds in southern California is largely made up of animal matter taken near the surf line on sandy beaches. Did *Chendytes* forage in deeper waters or on rocky reefs and retrieve animals that had to be wrenched from the rocks at the expense of greater effort?

STERNUM. Great interest attended the search for remains of the sternum of this completely flightless species. Hence our acute disappointment when only small fragments were retrieved. These fragments, however, tell something. At least two and probably three individuals are represented. The sternal plate is well developed, though in contrast to the pelvis, it is smaller than that of *Branta canadensis*, and the costal margin is strongly convex in the dorso-ventral plane. Six costal processes appear, but, in comparison with *Branta*, they are crowded more closely together. The suggestion is that the posterior part of the sternal plate was much reduced

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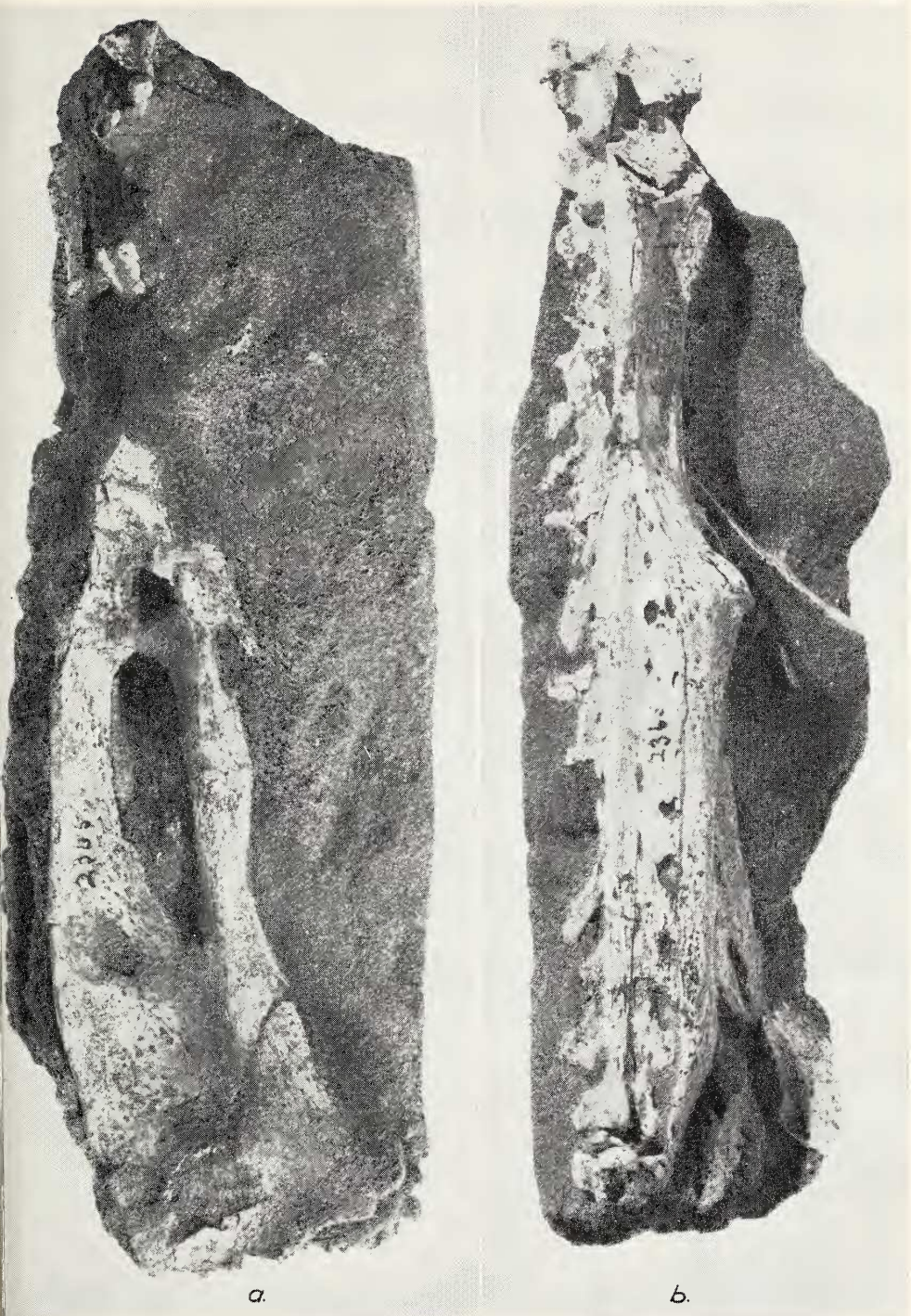
PLATE 2

Chendytes lawi Miller, pelvis, L.A.C.M. no. 2696. a. Internal view of left innominate; b. dorsal view of sacrum with right innominate in place.



a.

b.

as compared with *Branta*. A ventral-labial prominence is well developed, and a sterno-coracoidal impression is well defined. (See Howard, 1929, p. 316.) Only fragments of the coracoidal sulcus are preserved, but enough remains to show the ventral lip to be very shallow and the dorsal lip rounded over and thick at its margin. This indicates very little anterior extension of the sternal plate and probably a reduction of the sterno-coracoidal process.

One sternum (L.A. Co. Mus. no. 2701) lay in the matrix with the plate horizontal, but the whole median portion had been lost. The two costal borders are preserved in approximately their proper positions. They lie parallel on the block of sandstone, and we feel that they have not been appreciably separated by crushing. In the region of the third costal prominences this sternum measures 74 mm. across. *Branta c. canadensis* measures 67 mm. at the corresponding point. We feel that *Chendytes* had a short and broad sternum as do the surf scoters. Possibly this character was even exaggerated by a reduction of the posterior part of the sternal plate concurrent with the degeneracy of the great flight muscles. A comparable change appears to have taken place with loss of flight in the Galapagos Cormorant (*Nannopterum*), though wing reduction had not gone so far in that species as it had in the subject of this study.

A mere fragment of the manubrial portion of the sternum is preserved (L.A. Co. Mus. no. 2700), but it displays some interesting characters. The coracoidal sulci do not come together in the center as they do in *Melanitta*; they appear to have been separated by some distance not accurately determinable in the specimen. In *Melanitta* the anterior border of the manubrium is rendered sharp and thin by the dorsal lips of the closely approximated coracoidal sulci, but manubrial spines (found in *Branta*) are not developed. In the fossil bird the coracoidal sulci have retreated laterally, the anterior manubrial edge is thick, and the carina, which in living ducks and geese is thrust forward as a strongly developed keel, is represented only by a low, flat-topped ridge, raised but slightly above the transverse arching of the sternal plate. Our fragment is only 17 mm. in length along the sagittal line, but for this distance the carina is represented only by this flat-topped ridge which has a faint suggestion of a median sulcus. The flightless cormorant has less reduction of the carina than is here indicated, though a similar thickening or low ridge has been initiated posterior to the poorly developed keel.

CORACOID. Although at least three individuals are represented by their pelvic arches, and two or three by the sternum, there was recovered only one coracoid (L.A. Co. Mus. no. 2697). Fortunately this one specimen is essentially complete and had suffered almost no post mortem corrosion. The extreme edge of the outer border of the sterno-coracoidal process, if such had ever been present, is lost, but the distal parts of the bone are seemingly perfect. Howard (1947) described specimens of incomplete coracoid from the mainland as being "markedly flattened

and considerably distorted," and remarked that "in a very general way the modifications parallel those found in the Flightless Cormorant . . . though the fossil bones are much more flattened . . ." The complete coracoid from Anacapa Island bears out this statement of degeneracy. The total length is almost exactly equal to that of a coracoid of *Melanitta perspicillata*. Likewise the sternal base is the same width, but the shaft of the bone narrows and thins down to scarcely half the strength of *Melanitta*, and the head is reduced to about three-fourths the size. Furthermore, the contours of the head are less rugged, intermuscular lines across the shaft have disappeared, and the sternal facet at the base is reduced to about one-half the width of the entire base (see Plate 1, fig. b). The whole bone gives the impression of marked degeneracy such as one would expect from the characters of the humerus and the sternum. Measurements: length from head to internal distal angle, 47.5 mm.; distance from lower border of scapular facet to tip of head, 14.7 mm.; breadth of distal end, 19.1 mm.; breadth from glenoid facet to internal border of shaft below head, 8.0 mm.; depth at same place on internal border, 2.7 mm.

SKULL. The only portion of the skull heretofore recorded is an imperfect fragment of the premaxilla from which Howard (1955, p. 136) drew the conclusion that the bird had ". . . a relatively short, heavy beak with the nasal process broader than in any known anseriform."

The Anacapa site has provided us with a remarkably well preserved cranium and parts of the mandible (L.A. Co. Mus. no. 2699). Attached to the occiput were the atlas, axis and third cervical vertebra in practically perfect condition. The brain case has not been distorted, but pterygoids and palatines have been displaced and the sphenoidal rostrum fragmented. The quadrates are well preserved but the slender jugals are lost. The large lachrymals are seemingly perfect, but nasals and maxillaries are gone. Proximal parts of the mandibles, except the postarticular processes, are preserved though broken by movements of the matrix. The over-all impression is of a heavy, rugged skull larger than that of *Branta canadensis* and with a much longer and stronger beak.

The general aspect of the brain case is more nearly like that of the White-winged Scoter (*Melanitta deglandi*) than the Surf Scoter (*M. perspicillata*). In *M. deglandi* (as compared with *M. perspicillata*) the surface is more rugose; the dorsal bridge between the orbits is wider; the depressions for the nasal salt glands are deeper; the lachrymal is much larger and it approaches more closely the strong postorbital process. In all these respects the fossil skull resembles *M. deglandi*. It differs from both Recent species in its much greater size, the stronger pre- and postorbital processes, the heavier pterygoids, and the broader palatines which are of simpler pattern, concave on the dorsal surface and not so abruptly narrowed distally. Measurements: breadth across postorbital processes, 43.3 mm.; breadth of dorsal bridge between orbits, 12.0 mm.; breadth of cranium

posterior to the postorbital processes, 35.1 mm.; length from occipital condyle to anterior tip of palatines, 69.8 mm.

Muscle attachment to the mandible, below the coronoid process, is marked by an enlarged and rounded, papilla-like tuberosity, quite in contrast with the small, sharp tuberosity seen in *Melanitta*. The coronoid is strong, and the whole ramus is thickened insofar as preserved in the fossil. As discussed above, the strong cervical vertebrae suggest that *Chendytes* had marked ability to wrench off invertebrate animals that were attached to a hard substrate. That impression is accentuated by a study of the skull and mandible.

HUMERUS. The humerus has been figured by Howard (1955, fig. 1). The single specimen of this element (L.A. Co. Mus. no. 2698) in the Anacapa collection is somewhat better preserved. The head is complete. Although distinctly delineated, it lacks the sharp border and deep undercutting found in *Melanitta*. The distal articulations have been broken away, but the contours of the attachment of the brachialis anticus muscle are visible; the impression is very shallow. Compared with the specimen figured by Howard (op. cit.), the Anacapa humerus appears heavier of shaft, and a distinct swelling or excrescence causes a deviation in the external contour below the pectoral crest. Possibly this excrescence is an abnormality which is further reflected in the general heaviness of the shaft.

Records have accumulated during the past 35 years that show the genus *Chendytes* to have been quite widely distributed in southern California waters. How far to the north or to the south it may have dispersed seasonally is not yet known. Present records occur only south of Point Conception, from Ventura County to Orange County. We are inclined to consider it a product of the San Diegan biotic area. The instability of the earth's crust in this general area during Pliocene and Pleistocene time provided abundant island breeding sites that were conducive to the development of flightless species such as *Chendytes* and *Mancalla*.

SUMMARY

A newly discovered source of fossil bird remains on Anacapa Island has yielded much new information on *Chendytes lawi*. Skull, associated vertebrae, pectoral and pelvic elements and the humerus are described. Suggestions as to feeding habits are made and geologic correlation of the formation is proposed.

LITERATURE CITED

Howard, Hildegarde
1929. The Avifauna of Emeryville Shellmound. Univ. Calif. Publ. Zool. 33: 301-394.
1947. Wing elements assigned to Chendytes. Condor, 49: 76-77.
1949. Avian fossils from the marine Pleistocene of southern California. Condor, 51: 20-28.
1955. New records and a new species of Chendytes, extinct genus of diving geese. Condor, 57: 135-143.

Miller, Loye
1925. Chendytes, a diving goose from the California Pleistocene. Condor, 27: 145-147.

Orr, Phil C.
1960. Late Pleistocene marine terraces on Santa Rosa Island, California. Bull. Geol. Soc. Amer., 71: 1113-1120.

Scholl, D. W.
1960. Relationship of the insular shelf sediments to the sedimentary environments and geology of Anacapa Island, California. Jour. Sed. Petrology, 30(1): 123-139.